

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-016341

(43)Date of publication of application : 18.01.2002

(51)Int.Cl.

H05K 3/00  
H01L 23/12

(21)Application number : 2000-198258

(71)Applicant : NGK SPARK PLUG CO LTD

(22)Date of filing : 30.06.2000

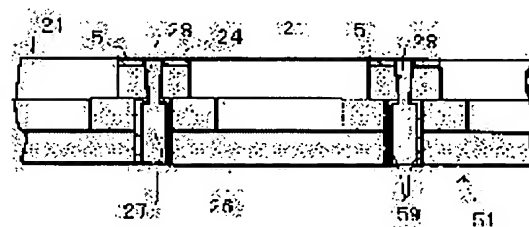
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## (54) METHOD FOR PRODUCING JOINT CERAMIC WIRING BOARD AND METHOD FOR PRODUCING WIRING BOARD

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a method for producing a joint ceramic wiring board and a method for producing a wiring board in which a plating layer of sufficient thickness can be formed uniformly on a metallize layer in a second major surface side recess.

**SOLUTION:** The method for producing a joint ceramic wiring board comprises a step for forming a first brake groove 28 communicating with a second major surface side recess 27 by inserting a first groove forming cutter 40 from the first major surface 24 side along the outer circumferential boundary line at each product part 21, a step for firing a large unfired ceramic sheet 31 to produce a joint ceramic wiring board 51 having a sealing metallize layer 5 formed along the first brake groove 28 wherein the firing shrinkage rate of a metallize paste forming an unfired metallize layer 25 is set higher than that of a ceramic green sheet forming the large unfired ceramic sheet 31.



## LEGAL STATUS

[Date of request for examination]

13.07.2006

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the  
examiner's decision of rejection or application  
converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of  
rejection][Date of requesting appeal against examiner's decision  
of rejection]

[Date of extinction of right]

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CLAIMS

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## [Claim(s)]

[Claim 1] The product section which has the 1st principal plane and the 2nd principal plane, and serves as many wiring substrates after division, The 1st principal plane side crevice for electronic-parts loading which carries out opening to the 1st principal plane side, and the metallized layer for non-calcinated closure which surrounded the 1st principal plane side crevice inside the periphery borderline of each product section, and was prepared in it, The 2nd principal plane side crevice which carries out opening to the 2nd principal plane side, is prepared on the periphery borderline of each product section by the side of the 2nd principal plane, and has a non-calcinated crevice metallized layer in an internal surface, The process which inserts the 1st slot formation cutting edge from the 1st principal plane side in accordance with the periphery borderline of each product section to a preparation \*\*\*\* baking ceramic oban, and forms the 2nd principal plane side crevice and the 1st breaking slot open for free passage, The metallized layer for closure which calcinated the above-mentioned non-calcinated ceramic oban and was formed along the 1st breaking slot, The baking process used as the connection ceramic wiring board which has the crevice metallized layer formed in the 2nd principal plane side crevice, The plating process which plates on the above-mentioned metallized layer for closure, and a crevice metallized layer, The manufacture approach of the connection ceramic wiring board characterized by the burning shrinkage making larger than the burning shrinkage of a ceramic green sheet which makes the above-mentioned non-calcinated ceramic oban the metallizing paste which makes a preparation and the above-mentioned metallized layer for non-calcinated closure.

[Claim 2] The product section which has the 1st principal plane and the 2nd principal plane, and serves as many wiring substrates after division, The 1st principal plane side crevice for electronic-parts loading which carries out opening to the 1st principal plane side, and the metallized layer for non-calcinated closure which surrounded the 1st principal plane side crevice inside the periphery borderline of each product section, and was prepared in it, The 2nd principal plane side crevice which carries out opening to the 2nd principal plane side, is prepared on the periphery borderline of each product section by the side of the 2nd principal plane, and has a non-calcinated crevice metallized layer in an internal surface, The process which inserts the 1st slot formation cutting edge from the 1st principal plane side in accordance with the periphery borderline of each product section to a preparation \*\*\*\* baking ceramic oban, and forms the 2nd principal plane side crevice and the 1st breaking slot open for free passage, The metallized layer for closure which calcinated the above-mentioned non-calcinated ceramic oban and was formed along the 1st breaking slot, The baking process used as the connection ceramic wiring board which has the crevice metallized layer formed in the 2nd principal plane side crevice, The adhesion process which pastes up a closure ring on the above-mentioned metallized layer, and the plating process which plates on the above-mentioned metallized layer for closure, and a crevice metallized layer, The manufacture approach of the connection ceramic wiring board characterized by the burning shrinkage making larger than the burning shrinkage of a ceramic green sheet which makes the above-mentioned non-calcinated ceramic oban the metallizing paste which makes a preparation and the above-mentioned metallized layer for non-calcinated closure.

[Claim 3] The manufacture approach of the connection ceramic wiring board according to claim 1 or 2 characterized by the burning shrinkage of said metallizing paste being in the range of 1.01-1.3 when burning shrinkage of said ceramic green sheet is set to 1.

[Claim 4] The width of face on said 1st principal plane of said 1st breaking slot is the manufacture approach of the connection ceramic wiring board according to claim 1 to 3 characterized by being smaller than the path of said 2nd

principal plane side crevice.

[Claim 5] It is the manufacture approach of the connection ceramic wiring board according to claim 1 to 4 which said 1st slot formation cutting edge is located between the plate-like part which has predetermined thickness, the point which has a predetermined tool angle, and the above-mentioned plate-like part and a point, has the pars intermedia which has a taper angle smaller than the tool angle of the above-mentioned point, and is characterized by for said 1st breaking slot to insert and form the above-mentioned 1st slot formation cutting edge to the above-mentioned pars intermedia.

[Claim 6] The manufacture approach of the wiring substrate which carries out an individual division at each wiring substrate by dividing the connection ceramic wiring board manufactured by the manufacture approach of a connection ceramic wiring board according to claim 1 to 5 for every product section along said 1st breaking slot.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Field of the Invention] In this invention, it is related in detail about the manufacture approach of a connection ceramic wiring board, and the manufacture approach of a wiring substrate to the manufacture approach of the connection ceramic wiring board used as the wiring substrate made from a ceramic (lead loess chip carrier) used as a package which closes electronic parts, such as an SAW filter, a quartz resonator, a transistor, a light emitting device, and IC, after division, and the manufacture approach of the wiring substrate which divides the connection ceramic wiring board and is obtained.

[0002]

[Description of the Prior Art] The wiring substrate 61 for the electronic-parts receipt for holding small electronic parts, such as an SAW filter and a light emitting device, conventionally The 1st principal plane side crevice (cavity) 62 for consisting of electrical insulation materials, such as an alumina ceramic, as shown in drawing 6, and carrying electronic parts in the 1st principal plane (top face) 64 center, a tungsten, On the metallized layer for wiring which consists of refractory metal powder, such as molybdenum, and the 1st principal plane, surround the 1st principal plane side crevice 62, and it is prepared. It has the metallized layer 65 for closure of the shape of a flat-surface rectangular-head frame by which a metal lid is joined to a top face. Electronic parts are carried connecting each electrode of electronic parts to the above-mentioned metallized layer for wiring electrically into the 1st principal plane side crevice 62, a metal lid is joined to the metallized layer 65 for closure through sealing agents, such as a pewter, after an appropriate time, and it becomes a final product by carrying out the hermetic seal of the electronic parts.

[0003] Thus, in the ceramic green sheet which consists of an alumina with which the metallizing paste (ink) which makes the metallized layer 65 the object for wiring layers and for closure was printed, it is stuck by pressure, this is calcinated and, usually the wiring substrate 61 made from a ceramic used is manufactured [ a laminating and ]. In order that such a wiring substrate 61 may raise productivity, it uses the ceramic green sheet of the form where the wiring substrate parts (product section) of dozens thru/or hundreds were connected in all directions as a laminating and the connection ceramic wiring board 81 with which it was stuck by pressure, and calcinated in the condition, and many substrates were connected in all directions, and is usually mass-producing it what (it breaks) this is divided for per each substrate by the final process (refer to drawing 7 ).

[0004] and in order to enable such division after baking, in the phase of the ceramic green sheet layered product (it takes to this description and is called a non-calcinated ceramic oban) by which the laminating was carried out, it usually comes out to the adjoining boundary between substrate partial to put in the 1st breaking slot 78 (only henceforth a slot), and it is in it (refer to drawing 7 ). That is, the non-calcinated ceramic oban containing a slot is calcinated, layer arrival of the deposit which becomes the exposure front face of the metallized layer 65 for closure and the metallized layer for wiring from nickel and gold is carried out one by one by electrolytic plating, and it considers as the connection ceramic wiring board 81 in which the 1st breaking slot 78 was formed, and it takes a break along the 1st breaking slot 78 (fragmentation), and an individual division is carried out per substrate.

[0005] By the way, as for the wiring substrate 61 made from a ceramic, the metallized layer for wiring is drawn at the lateral-surface and 2nd principal plane 66 side through the notching metallized layer 69 by which two or more formation is

carried out and the notch 67 of the shape of a cross-section abbreviation semicircle with a radius of about 0.2mm was formed in that side face at the internal surface of this notch 67. Therefore, the 2nd principal plane side crevice 77 of the shape of a cross-section approximate circle used as the notch 67 for connecting a wiring substrate to a mounting substrate and an electric target after division is formed in the connection ceramic wiring board 81. If the crevice metallized layer 79 is formed in that inner skin and base and this 2nd principal plane side crevice 77 is divided, cross-section abbreviation semicircle-like a notch 67 and the notching metallized layer 69 will be formed in the lateral surface of a wiring substrate (refer to JP,2000-68414,A).

[0006] However, by closing one side, when carrying out layer arrival of a nickel-plating layer and the gold plate layer to the outside surface of the crevice metallized layer 79 by the electrolytic plating approach, since the crevice metallized layer 79 in the internal surface of the 2nd principal plane side crevice 77 has very bad circulation of the plating liquid in a crevice, it will not be able to carry out layer arrival of the plating thoroughly, and will be in the condition that the front face of the crevice metallized layer 79 was exposed. Therefore, if the moisture contained in this outcrop in atmospheric air adheres, this moisture will contact a nickel plating layer and a gold plate layer, and will work as an electrolyte, the electric operation to which a current flows from a difference of the energy level of both metals between a nickel plating layer and a gold plate layer is produced, a nickel plating layer with a low energy level is made eluted gradually, and the fault of short-circuit between the adjoining crevice metallized layers 79 is known ( refer to JP,6-33297,A).

[0007] In order to solve such a trouble, as shown in drawing 8 , the 1st breaking slot 88 by the side of the 1st principal plane and the 2nd principal plane side crevice 77 are made to open for free passage, and the method of circulating plating liquid through the 1st breaking slot 88 in the 2nd principal plane side crevice 77 is learned (refer to JP,9-74151,A).

[0008]

[Problem(s) to be Solved by the Invention] However, in order to make the 1st breaking slot and the 2nd principal plane side crevice open for free passage, as shown in the connection ceramic wiring board 91 of drawing 8 , only the part needs to form the 1st breaking slot deeply. If the tool angle of a slot formation cutting edge is large when the slot formation cutting edge for forming the 1st breaking slot is put in deeply, as shown in drawing 8 , the aperture width on the 1st principal plane 74 of the 1st breaking slot 88 becomes large, the metallized layer 65 for closure cannot form with sufficient width of face, or the problem that a wiring substrate will be enlarged will arise.

[0009] Moreover, like [ if the tool angle of a slot formation cutting edge is small ] the connection ceramic wiring board shown in drawing 9 , although the aperture width on the 1st principal plane 64 of the 1st breaking slot 98 can be controlled small The free passage section of the 1st breaking slot 98 especially the 1st breaking slot 98, and the 2nd principal plane side crevice 77 is closed by the springback before baking, joining at the time of baking, etc. (refer to JP,2000-141344,A). Nonconformities, such as poor plating in the 2nd principal plane side crevice 77 and breaking nature aggravation, might be caused. Since aggravation of such breaking nature has contraction as large as about 20% in the baking process of a ceramic substrate, it is considered to originate in the width of face of the 1st breaking slot 98 into which it was put before baking becoming narrow etc.

[0010] That such a problem should be solved conventionally, width of face of the breaking slot was enlarged, or the include angle of a slot (groove bottom) was enlarged, and it was coped with. However, in manufacture of the small wiring substrate in which only one several mm sides are, there is a limitation in such a cure naturally. And the number of slots in fixed spacing increases as the small oban for wiring substrates. On the other hand, after the breaking slot into which it was put with a press extracts a slot formation cutting edge, since [ which is restored a little with the elasticity of a ceramic green sheet ] it acts like (it closes), the flute width tends to become narrow and the welding of a breaking slot tends to generate it, so that a wiring substrate becomes small.

[0011] Moreover, in addition to such a problem, there were also the following problems in manufacture of the conventional substrate. The wiring substrate which the ring for closure (metal frame) which consists of covar etc. pastes up by low attachment etc. is manufactured as follows around the 1st principal plane among the wiring substrates made from a ceramic. That is, plating was applied to the metallized layer for closure formed along the surface perimeter, i.e., breaking slot, on the part of a substrate unit in the large-sized phase after baking, it set after that, low material (spherical or silver solder of cylindrical \*\*) was set to the metallized layer for closure of each substrate part, the seal ring has been arranged, and low attachment of this was carried out collectively. In arrangement of this ring, and low attachment, although a breaking slot makes the adjoining boundary between substrate partial, as for spacing (opening) of rings, only a gap minute

[ for a breaking slot ] is secured.

[0012] Thus, spacing of rings was a minute gap for a breaking slot, and moreover, since the flute width was narrow, the low fused at the time of low attachment might flow into the breaking slot, and might weld, might form the bridge in this slot, and might fill the slot. When it comes to such a condition, a free passage with the 1st breaking slot and the 2nd principal plane side crevice will no longer be secured, and the poor deposit arrival to the crevice metallized layer in the 2nd principal plane side crevice will arise. Moreover, like the problem by the welding of the above mentioned breaking slot, in order that trouble may appear in breaking, defects, such as a chip, are tend to occur for the product after division. And a smaller wiring substrate also tends to generate such a problem. In addition, as a measure for such a problem, it is possible from a breaking slot to set a ring if possible and to arrange distance. That is, although it is said that inflow of the melting low in if possible separating from a breaking slot (rim of a substrate) the metallized layer for closure which makes a ring adhesion side is prevented, the allowances on such a dimension do not have one side at the small substrate of several mm. Therefore, the manufacture yield of such a small substrate was very low conventionally. This invention sets it as the object to cancel the trouble on manufacture of such a wiring substrate made from a ceramic.

[0013]

[Means for Solving the Problem] In order to attain the above-mentioned object, invention according to claim 1 The product section which has the 1st principal plane and the 2nd principal plane, and serves as many wiring substrates after division, The 1st principal plane side crevice for electronic-parts loading which carries out opening to the 1st principal plane side, and the metallized layer for non-calcinated closure which surrounded the 1st principal plane side crevice inside the periphery borderline of each product section, and was prepared in it, The 2nd principal plane side crevice which carries out opening to the 2nd principal plane side, is prepared on the periphery borderline of each product section by the side of the 2nd principal plane, and has a non-calcinated crevice metallized layer in an internal surface, The process which inserts the 1st slot formation cutting edge from the 1st principal plane side in accordance with the periphery borderline of each product section to a preparation \*\*\*\* baking ceramic oban, and forms the 2nd principal plane side crevice and the 1st breaking slot open for free passage, The metallized layer for closure which calcinated the above-mentioned non-calcinated ceramic oban and was formed along the 1st breaking slot, The baking process used as the connection ceramic wiring board which has the crevice metallized layer formed in the 2nd principal plane side crevice, The plating process which plates on the above-mentioned metallized layer for closure, and a crevice metallized layer, It is characterized by the burning shrinkage making larger than the burning shrinkage of a ceramic green sheet which makes the above-mentioned non-calcinated ceramic oban the metallizing paste which makes a preparation and the above-mentioned metallized layer for non-calcinated closure.

[0014] In this description, the burning shrinkage of a metallizing paste shall mean contraction until a metallizing paste is calcinated, and the burning shrinkage of a ceramic green sheet shall mean contraction until a ceramic green sheet is calcinated.

[0015] In the manufacture approach of such a connection ceramic wiring board, when [ which many non-calcinated ceramic obans (only henceforth an oban) of picking are calcinated, and is divided along this slot through each process, such as plating, (the so-called chocolate breaking) ] put into the 1st breaking slot from the 1st principal plane side, it is as follows. In manufacture of such a wiring substrate, at a large-sized baking process, since the burning shrinkage of the metallized layer for non-calcinated closure in the perimeter of each product section (substrate part) is larger than that of a ceramic, an extended operation of this flute width is demonstrated in opening of the 1st breaking slot. That is, in order to serve to prevent that the breaking slot for closure welds in a baking process, it is prevented that a free passage with the 1st breaking slot and the 2nd principal plane side crevice is checked, or breaking nature falls.

[0016] In manufacture of this conventional kind of substrate, in order to prevent generating of nonconformities, such as deformation of the curvature of a substrate etc., and cutting of internal wiring, by the difference of the burning shrinkage of a ceramic and a metallized layer, what was prepared so that that burning shrinkage might become the same as that of the burning shrinkage of a ceramic green sheet as much as possible was used. Therefore, a calcinated oban is contracted to homogeneity about the whole by being calcinated. On the other hand, the width of face of the breaking slot into which it is put before baking is as minute as about 0.05-0.08mm, and since this becomes narrow similarly by burning shrinkage, it is thought that the 1st breaking slot tends to start welding.

[0017] On the other hand, by this invention, it writes as a larger thing than the burning shrinkage of the ceramic to which

the burning shrinkage makes the wiring substrate made from a ceramic for the metallized layer for closure around a principal plane (the 1st principal plane) in a substrate, and the metallized layer for closure is shrunk by the aforementioned process more greatly than a ceramic. that is, in the aforementioned process, the metallized layer for closure which be in the perimeter of the product section (substrate part) of the both sides of the 1st breaking slot when an oban be seen superficially act the width of face of the 1st breaking slot so that the opening side may be made to open, in order to compress a surface ceramic along the field of the metallized layer for non-calcinated closure, respectively in a baking process. Therefore, after baking, since the width of face of a slot spreads when the metallized layer for non-calcinated closure of the same burning shrinkage as a ceramic is used like before, welding is prevented. In this way, after that, the deposit arrival nature to the crevice metallized layer in the 2nd principal plane side crevice is improved, and as a result of preventing generating of the nonconformity at the time of carrying out an individual division along the 1st breaking slot, improvement in the manufacture yield is achieved.

[0018] And the product section which invention according to claim 2 has the 1st principal plane and the 2nd principal plane, and serves as many wiring substrates after division, The 1st principal plane side crevice for electronic-parts loading which carries out opening to the 1st principal plane side, and the metallized layer for non-calcinated closure which surrounded the 1st principal plane side crevice inside the periphery borderline of each product section, and was prepared in it, The 2nd principal plane side crevice which carries out opening to the 2nd principal plane side, is prepared on the periphery borderline of each product section by the side of the 2nd principal plane, and has a non-calcinated crevice metallized layer in an internal surface, The process which inserts the 1st slot formation cutting edge from the 1st principal plane side in accordance with the periphery borderline of each product section to a preparation \*\*\*\* baking ceramic oban, and forms the 2nd principal plane side crevice and the 1st breaking slot open for free passage, The metallized layer for closure which calcinated the above-mentioned non-calcinated ceramic oban and was formed along the 1st breaking slot, The baking process used as the connection ceramic wiring board which has the crevice metallized layer formed in the 2nd principal plane side crevice, The adhesion process which pastes up a closure ring on the above-mentioned metallized layer, and the plating process which plates on the above-mentioned metallized layer for closure, and a crevice metallized layer, It is characterized by the burning shrinkage making larger than the burning shrinkage of a ceramic green sheet which makes the above-mentioned non-calcinated ceramic oban the metallizing paste which makes a preparation and the above-mentioned metallized layer for non-calcinated closure.

[0019] Plating is applied to the metallized layer for closure around each product section (substrate part) in a connection ceramic wiring board, and other metallized layers, it sets after that, low material is set, low attachment of the ring is arranged and carried out after that, and such a connection ceramic wiring board takes a break for each substrate of every, after applying further predetermined plating. Therefore, as for the large-sized 1st breaking slot, in said process, the opening side receives an extended operation also about such a substrate. That is, since the 1st breaking slot which makes spacing of the adjoining closure rings between the product sections spreads rather than the case where it is based on the conventional technique, nonconformity of the low fused at the time of low attachment of the part and a closure ring flowing, welding plugging up the free passage part of the 1st breaking slot and the 2nd principal plane side crevice into the 1st breaking slot, or forming a bridge in it cannot produce it easily.

[0020] In which the above-mentioned approach, since there is an extended operation of a flute width in a baking process, it is hard to weld the 1st breaking slot, and when carrying out low attachment of the ring for closure, adhesives (low) cannot form a bridge easily. Therefore, also in which approach, the nonconformity at the time of the breaking made into a product section unit is avoided. Moreover, since the 1st breaking slot is minded and plating liquid circulates and circulates into the 2nd principal plane side crevice, electrolysis deposit formation to the metallized layer in the 2nd principal plane side crevice can also be performed good. In addition, also in which approach, when burning shrinkage of said ceramic green sheet is set to 1, it is desirable to make it the burning shrinkage of said metallizing paste be in the range of 1.01-1.3.

[0021] Moreover, as for the width of face on said 1st principal plane of said 1st breaking slot, it is desirable to make it smaller than the path of said 2nd principal plane side crevice. In order to carry out the maximum reservation of the width of face of the metallized layer for closure, responding to the request of a miniaturization of a wiring substrate, it is desirable to preferably [ the aperture width of the 1st breaking slot on the 1st principal plane / making it as small as possible ] and specifically make it smaller than the path of the 2nd principal plane side crevice. The reason originally used as the closed-end hole, without making the 2nd principal plane side crevice penetrate to the 1st principal plane side Since



it is for securing tooth space sufficient on the 1st principal plane preparing the metallized layer for closure, as shown in drawing 5 of JP,9-74151,A. If aperture width of the 1st breaking slot on the 1st principal plane is made into the path of the 2nd principal plane side crevice more than an EQC, the original effectiveness which used the 2nd principal plane side crevice as the closed-end hole will no longer be acquired.

[0022] Furthermore, said 1st slot formation cutting edge is good to have the pars intermedia which is located between the plate-like part which has predetermined thickness, the point which has a predetermined tool angle, and the above-mentioned plate-like part and a point, and has a taper angle smaller than the tool angle of the above-mentioned point. As for the tool angle of a point, it is desirable to suppose that it is comparatively large (obtuse angle), in order to prevent the welding of the 1st breaking slot, and in order to make aperture width of the 1st breaking slot on the 1st principal plane into the minimum, as for the taper angle of pars intermedia, it is desirable to make it comparatively small.

[0023] In addition, in order to prevent springback and joining, the tool angle of the point of the 1st breaking cutting edge has desirable 30 degrees or more, and is more desirable. [ of 35 degrees or more ] Moreover, the include angle of pars intermedia has desirable 30 degrees or less, and its 25 degrees or less are more desirable.

[0024] In addition, as for said 1st breaking slot, it is desirable to insert and form said 1st slot formation cutting edge to the above-mentioned pars intermedia. It is because nonconformity, such as having ground the side attachment wall of the 1st breaking slot, and producing weld flash near the 1st breaking slot opening on the 1st principal plane, when drawing out the 1st slot formation cutting edge, will occur if the 1st slot formation cutting edge is inserted to a plate-like part (straight section). In addition, in order to prevent grinding raising of the side attachment wall of a breaking slot, the include angle of pars intermedia has 5 degrees or more and more desirable 10 more degrees or more.

[0025] Furthermore, this invention includes the manufacture approach of the wiring substrate which carries out an individual division in each wiring substrate by dividing the connection ceramic wiring board manufactured by the manufacture approach of the above-mentioned connection ceramic wiring board for every product section along said 1st breaking slot. Since the welding in the 1st breaking slot is prevented, the connection ceramic wiring board obtained by the above-mentioned manufacture approach is divided with a sufficient precision. And since the deposit is formed in homogeneity also at the crevice metallized layer in the 2nd principal plane side crevice, the side-face electrode excellent in corrosion resistance can be formed in the notch of the shape of a cross-section approximate circle which divided the 2nd principal plane side crevice and was acquired.

[0026]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained, referring to drawing. The wiring substrate 1 made from a ceramic manufactured by this example is shown in drawing 1. The wiring substrate 1 made from this ceramic has nothing, the 1st principal plane (top face) 4, and the 2nd principal plane (underside) 6 for the shape of a 3.8x3.8x1.1mm abbreviation rectangle. It was formed in rectangle tabular by the laminated structure of three layers, and the wiring substrate 1 went in the center caudad by the plane view rectangle, it is stair-like and is equipped with the mold cavity (crevice) 2 used as narrow. And the metallized layer 5 for closure which uses refractory metals, such as a tungsten and molybdenum, as a principal component is formed in the perimeter of the 1st principal plane 4 of the wiring substrate 1 in the shape of a plane view rectangular-head frame by predetermined width of face. Although a graphic display is not carried out to this metallized layer 5, a nickel-plating layer is formed, and the gold plate layer is further formed in the outermost surface.

[0027] Moreover, the semicircle tubed notch 7 (the diameter of 0.3mm, height of 0.8mm) is formed in the side face of a wiring substrate. The notching metallized layer 9, and the nickel-plating layer and gold plate layer which were further put on the front face were formed in the internal surface, the side-face electrode is accomplished, and it has flowed with the internal metallized layer for wiring (not shown). These notches 7 are inclined and formed in the 2nd principal plane 6 side. That is, unlike the periphery edge of the 2nd principal plane 6, the depression by the semicircle tubed notch 7 does not exist in the periphery edge of the 1st principal plane 4. For this reason, the metallized layer 5 for closure can be formed to near the periphery edge of the 1st principal plane 4 irrespective of the existence of a notch 7.

[0028] As for the metallized layer 5 for closure, 20% of thing is used [ such a wiring substrate 1 ] for burning shrinkage, as for both the metallized layers to which the burning shrinkage makes internal wiring with which 25% of thing is used and degree ceramic to make and others do not illustrate a substrate 1 although it is manufactured as an account is carried out. In addition, the lid which electronic parts are carried in a cavity 2 and illustrated after that at an after process is put, and

the hermetic seal of such a wiring substrate 1 is soldered and carried out to a metallized layer 5.

[0029] Now, the suitable process of such a substrate 1 is explained to a detail with reference to drawing 2 thru/or drawing 5 below. First, the ceramic green sheet (0.25–0.3mm in thickness) which uses as a principal component the alumina (aluminum 2O3) formed so that the substrate part of a nothing predetermined number could take each ceramic layer of a substrate 1 is manufactured, respectively. And it cuts in the configuration corresponding to each ceramic layers 11, 12, and 13, and is pierced and made it, and metallizing pastes, such as a common conductor layer for electrolytic plating, are printed to the metallized layer for closure, or a wiring layer pan.

[0030] a metallizing paste becomes the same as the burning shrinkage (this gestalt 20%) of a ceramic green sheet except what makes the metallized layer 5 for closure printed by the front face of the ceramic green sheet which makes the maximum upper layer — as — for example, W(tungsten):M\*\* (molybdenum) — what was prepared so that it might become the weight ratio of :aluminum2O3(alumina) = 95:5:3 was used. only in the metallizing paste printed on the other hand so that the metallized layer 5 for closure may be made, burning shrinkage becomes 25% — as — W:M\*\* — what prepared :aluminum 2O3 so that it might become the weight ratio of 90:10:1 was used, and it printed by 0.02–0.04mm in thickness. In addition, W and M \*\* which are contained in the metallizing paste which makes this metallized layer 5 for closure used the thing with a particle size of 1.0–2.0 micrometers.

[0031] in this way, the manufactured ceramic green sheet is consisted of a laminating and three-layer ceramic layers 11, 12, and 13 which are stuck by pressure and shown in drawing 2 — un—— baking ceramic oban 31 was manufactured. 25 are the metallizing paste (non-calcinated closure metallized layer) printed on the 1st principal plane 24 so that the metallized layer for closure might be made after baking among this drawing. such — un—— in baking ceramic oban 31, it usually comes out that the product section 21 stands in a row, and is arranged continuously in all directions so that only an outermost handle part (frame) may throw away and it may become \*\*. Moreover, with this gestalt, the metallized layer 25 for non-calcinated closure is similarly printed and formed to the boundary approach part with the outermost product section 21 among handle parts (frame). Moreover, the 2nd principal plane side crevice 27 formed in the 2nd principal plane 26 side by carrying out opening to the 2nd principal plane 26 side so that it might become a notch 7 after calcinating and dividing a non-calcinated ceramic oban is formed on the periphery borderline of each product section 21. Moreover, the non-calcinated crevice metallized layer 29 which turns into the crevice metallized layer 19 after baking, and turns into the notching metallized layer 9 after division is formed in the internal surface of each 2nd principal plane side crevice 27.

[0032] next, such — un—— the 1st slot formation cutting edge 40 (refer to drawing 4 ) is predetermined-depth(the principal-plane [ 1st ]-side to for example, 40 – 50% of overall thickness )-inserted, and the 1st breaking slot 28 is formed in the boundary of the product section 21 by the side of baking ceramic oban 31, for example, the 1st principal plane, so that the shape of a grid may be made in all directions (refer to drawing 3 ). In addition, although explanation is omitted with this operation gestalt, it is good to form the 2nd breaking slot also in the 2nd principal plane 26 side, when a predetermined depth, for example, 2nd principal plane, side to overall thickness inserts the 2nd slot formation cutting edge into the location corresponding to the 1st breaking slot 28 10 to 20%. However, the 1st breaking slot 28 makes the boundary between product section 21, and is cutting the metallizing paste 25 for closure (layer) in the center of abbreviation of the cross direction in the 1st principal plane 24.

[0033] Moreover, in case the 1st breaking slot 28 is formed, the 1st slot formation cutting edge 40 is inserted to the depth which penetrates the base of the 2nd principal plane side crevice 27. According to this process, the 2nd principal plane side crevice 27 which has the non-calcinated crevice metallized layer 29 in an internal surface not only carries out opening to the 2nd principal plane 26 side, but will be led to the 1st principal plane 24 side. Opening (free passage section) with a width of face of 0.05mm – 0.08mm is formed in the center of abbreviation of the base of the approximate circle configuration of the 2nd principal plane side crevice 27 of the 1st breaking slot 28, and, specifically, the 2nd principal plane side crevice 27 and the 1st breaking slot 28 are open for free passage.

[0034] Specifically, the 1st breaking slot 28 is formed using the 1st slot formation cutting edge 40 of structure as shown in drawing 4 . namely, the 1st slot formation cutting edge 40 — abbreviation — the parallel plate-like part 41, the point 42 of 40 degrees of tool angles, and the pars intermedia 43 that has a 18-degree taper angle — since — it becomes. In accordance with the periphery borderline of each wiring substrate field 21, the 1st breaking slot 28 is formed by inserting such a 1st slot formation cutting edge 40 into sheep baking ceramic oban 31 (referring to drawing 3 ), and drawing it out from the 1st principal plane 24 side to the middle of pars intermedia 43, (refer to drawing 5 ). In addition, the width of face



of the 1st breaking slot 28 on the 1st principal plane 24 is about 0.2mm, is made smaller than the path of the 2nd principal plane side crevice 27, and can form the metallized layer 25 for non-calcinated closure broadly that much.

[0035] Since a point 42 makes a tool angle 30 degrees or more (this operation gestalt 40 degrees), it can prevent effectively the springback before baking, and joining at the time of baking. moreover, since the aperture width on the 1st principal plane 24 does not become not much large even if it inserts the 1st slot formation cutting edge 40 until deeply, since pars intermedia 43 serves as a taper angle (this operation gestalt 5 degrees or more 30 degrees or less, 18 degrees) smaller than a tool angle, the metallized layer 25 for non-calcinated closure which makes the metallized layer 5 for closure can be formed by sufficient width of face. Furthermore, since the 1st slot formation cutting edge 40 is inserted to the middle of the pars intermedia 43 which has a taper angle 5 degrees or more (this operation gestalt 18 degrees), it can sample without having ground and can prevent that weld flash occurs near the opening by the side of the 1st principal plane 24 of the 1st breaking slot 28. In addition, with this operation gestalt, although the 1st breaking slot 28 (and the 2nd breaking slot) was put in after printing / formation of the metallized layer for non-calcinated closure, as long as it is after shaping of a ceramic green sheet and before baking, you may put in before printing / formation of the metallized layer for non-calcinated closure.

[0036] Subsequently, this sheep baking ceramic oban 31 is calcinated, and it considers as a connection ceramic wiring board (calcinated oban). Thus, the 1st breaking slot 28 which makes the boundary of each obtained finishing baking large-sized substrate part is deforming so that an opening side may be extended. That is, after baking is caused non-calcinated ceramic oban 31 as seeing as the whole oban by the burning shrinkage of a ceramic, and is thin small 20% of abbreviation.

[0037] On the other hand, in this baking process, since only the surface metallized layer 25 for non-calcinated closure has contraction as large as 25%, it acts in each field in which the metallized layer 5 for closure exists among the outermost surfaces of the ceramic layer 11 by the side of that difference [ 5% of ] minute and 1st principal plane, so that the outermost surface of the ceramic layer 11 may be shrunk along that field. In each field in which the metallized layer 25 for non-calcinated closure exists, in order to receive the force which the ceramic layer 11 which touches this contracts along a front face by the burning shrinkage of the metallized layer 25 for non-calcinated closure, it deforms so that it may be compressed along this front face. The deformation serves as max in the outermost surface of the ceramic layer 11.

[0038] As for the connection ceramic wiring board 51 which calcinates according to such an operation in a baking process since it becomes larger than the part and the opening condition of the conventional slot in order that the operation which extends the flute width may work in the 1st breaking slot 28 where the metallized layer 25 for non-calcinated closure exists in both sides, and is obtained, welding or closing were positively prevented for the 1st breaking slot 28. Moreover, the metallized layer 25 for non-calcinated closure and the non-calcinated crevice metallized layer 29 turn into the metallized layer 5 for closure, and the crevice metallized layer 59 according to this baking process. In addition, other parts shall be indicated with the same sign about baking before and the baking back for simplification.

[0039] In this way, the obtained connection ceramic wiring board (baking substrate) 51 is completed as a connection ceramic wiring board (calcinated oban) by applying nickel (nickel) plating and golden (Au) plating by electrolytic plating to the metallized layer 5 for closure etc. after that. Also in this plating process, since there is no welding in the 1st breaking slot 28 and the free passage with the 2nd principal plane side crevice 27 is fully secured, it also sets in the 2nd principal plane side crevice 27, plating liquid fully circulates and circulates, and a nickel-plating layer and a gold plate layer can be formed by homogeneity and sufficient thickness on the metallized layer of 2nd principal plane side crevice 27 internal surface.

[0040] Next, the connection ceramic wiring board 51 to which plating was applied is made into the shape of a strip of paper by what (it breaks) is taken a break along a breaking slot, and many wiring substrates 1 made from a ceramic shown in drawing 1 are obtained at once by taking a break further, so that it may become every substrate. In this breaking, as for the breaking slot of the connection ceramic wiring board 51, that activity is done smoothly. Moreover, since the metallizing paste was printed with this gestalt like [ a boundary approach part with the outermost product section 21 ] the metallized layer 25 for non-calcinated closure among handle parts (frame), also in the outermost 1st breaking slot 28, welding is prevented effectively. That is, according to the wiring substrate of this gestalt, and its process, since generating of nonconformities, such as KAKE in breaking, is prevented, the manufacture yield can be raised.

[0041] In addition, what is necessary is for the presentation of the metallized layer for closure (paste) to be the range where a suitable extended operation of a flute width is acquired, and just to set it up suitably in this invention, in

consideration of the burning shrinkage of the ceramic which makes a substrate, so that burning shrinkage may become large from the burning shrinkage of a ceramic. In order to enlarge burning shrinkage, it is effective to gather the content of molybdenum and to make small particle size of the molybdenum to contain and a tungsten. It is because the one of a degree of sintering where a thing with molybdenum more sufficient [ a degree of sintering ] (contraction is large) and particle size are smaller than a tungsten is good.

[0042] In addition, according to the following processes, a gold plate layer may not be prepared in a front face, but where only a nickel-plating layer is formed, low attachment of the closure ring may be carried out on the metallized layer 5 for closure at the connection wiring substrate manufactured according to said operation gestalt. Preforming of the low material (silver solder) of the shape of a plane view rectangular-head frame corresponding to the metallized layer 5 for closure of each product section 21 is laid on each metallized layer 5 for closure; it carries out heating and melting, and low material is formed on the metallized layer 5 for closure. Then, the closure ring which consists of plane view rectangular-head frame-like covar is laid on the metallized layer 5 for closure on which low material was made to put beforehand, in such the condition, again, heating melting of the low material is carried out, and soldering of a closure ring is completed.

[0043] the oban which finished low attachment of a closure ring — every after 1 plates nickel plating, Au plating, etc. on the front face of a seal ring, and the front face of each wiring layer — it is divided along the 1st breaking slot 14, and becomes many wiring substrates (chip carrier). After electronic parts, such as an SAW filter, are carried in a cavity 2, a wiring substrate makes it a seal ring to join a lid etc., and is used for it.

[0044] Moreover, in the above-mentioned operation gestalt, although pars intermedia illustrated only one slot formation cutting edge, the slot formation cutting edge which has two or more pars intermedia where taper angles differ can also be used. For example, the slot formation cutting edge with which a point has 40 degrees and the 1st pars intermedia has the pars intermedia of plurality [ pars intermedia / 25 degree and / 2nd ] like 18 degrees can also be used.

[0045] Furthermore, although it is more desirable to use the slot formation cutting edge which has pars intermedia as described above, it is not necessarily limited to this but the slot formation cutting edge which does not have pars intermedia as well as the former can also be used. In that case, it is good to make a tool angle into 10 degrees – about 35 degrees so that the aperture width on the 1st principal plane may not become large too much. Even in this case, it can prevent that write as a larger thing than the burning shrinkage of the ceramic to which that burning shrinkage makes the wiring substrate made from a ceramic for the metallized layer for closure around a principal plane (the 1st principal plane) in a substrate, that metallized layer for closure is shrunken more greatly than a ceramic, and the 1st breaking slot is closed.

[0046] Moreover, a design change is carried out suitably and the wiring substrate made from a ceramic of this invention can materialize that shape can be taken regardless of the configuration thru/or structure etc., unless it deviates from the summary of this invention. Moreover, the thing made from ceramics other than aluminas, such as a thing made from the glass ceramic of low-temperature baking, alumimium nitride, and silicon nitride, can also be included in the wiring substrate made from a ceramic of this invention.

[0047]

[Effect of the Invention] According to this invention, the flute width of the 1st breaking slot can be made to extend in the baking process of a non-calcinated ceramic oban in manufacture of a wiring substrate so that clearly from the above explanation. Therefore, since it can prevent poor plating and poor breaking of a connection ceramic wiring board which originate in the welding of the 1st breaking slot etc. like before, improvement in the manufacture yield in this kind of process is achieved. According to this invention, in manufacture of the small wiring substrate made from a ceramic, a remarkable thing is in the effectiveness like the lead loess chip carrier used for a quartz resonator etc.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] The perspective view which looked at the example of an operation gestalt of the wiring substrate made from a ceramic concerning this invention from the closure side side.

[Drawing 2] The sectional view of a non-calcinated ceramic oban used by this invention.

[Drawing 3] The explanatory view showing the process which forms a breaking slot in the non-calcinated ceramic oban shown in drawing 2 .

[Drawing 4] The sectional view near the head of the slot formation cutting edge used with the breaking slot formation process of drawing 3 .

[Drawing 5] The partial expanded sectional view of the connection ceramic wiring board concerning this invention.

[Drawing 6] The sectional view of the conventional wiring substrate made from a ceramic.

[Drawing 7] The partial expanded sectional view of the conventional connection ceramic wiring board.

[Drawing 8] The partial expanded sectional view of other conventional connection ceramic wiring boards.

[Drawing 9] The partial expanded sectional view of other conventional connection ceramic wiring boards.

[Description of Notations]

1 Wiring Substrate made from Ceramic

2 1st Principal Plane Side Crevice (Cavity)

4 1st Principal Plane

5 Metallized Layer for Closure

6 2nd Principal Plane

7 Notch

9 Notching Metallized Layer

11, 12, 13 Ceramic layer

21 Product Section

25 Metallized Layer for Non-Calcinated Closure (Metallizing Paste)

27 2nd Principal Plane Side Crevice

28 1st Breaking Slot

29 Non-Calcinated Crevice Metallized Layer

31 Non-Calcinated Ceramic Oban

40 1st Slot Formation Cutting Edge

41 Plate-like Part

42 Point

43 Pars Intermedia

51 Connection Ceramic Wiring Board

59 Crevice Metallized Layer

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(19) 日本国特許庁 (J P)

(12) 公 開 特 許 公 報 (A)

(11) 特許出願公開番号

特開2002-16341

(P2002-16341A)

(43) 公開日 平成14年1月18日 (2002.1.18)

(51) Int.Cl. <sup>7</sup>	識別記号	F I	データベース* (参考)
H 0 5 K 3/00		H 0 5 K 3/00	X
H 0 1 L 23/12		H 0 1 L 23/12	B

審査請求 未請求 請求項の数 6 O L (全 9 頁)

(21) 出願番号 特願2000-198258 (P2000-198258)

(22) 出願日 平成12年6月30日 (2000.6.30)

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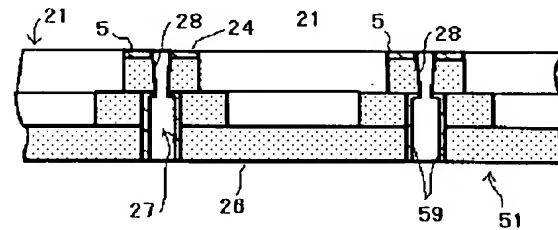
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(54) 【発明の名称】 連結セラミック配線基板の製造方法、および配線基板の製造方法。

(57) 【要約】

【課題】 第2主面側凹部内の凹部メタライズ層に均一かつ十分な厚みのメッキ層を形成することが可能な連結セラミック配線基板の製造方法および配線基板の製造方法を提供すること。

【解決手段】 第1主面24側から各製品部21の外周境界線に沿って第1溝形成刃40を差し入れ、第2主面側凹部27と連通する第1ブレード溝28を形成する工程と、未焼成セラミック大判31を焼成し、第1ブレード溝28に沿って形成された封止用メタライズ層5を有する連結セラミック配線基板51とする焼成工程と、を備え、上記未焼成メタライズ層25をなすメタライズペーストをその焼成収縮率が、上記未焼成セラミック大判31をなすセラミックグリーンシートの焼成収縮率より大きいものとしたことを特徴とする連結セラミック配線基板の製造方法。



## 【特許請求の範囲】

【請求項1】 第1主面及び第2主面を有し、分割後に多数の配線基板となる製品部と、第1主面側に開口する電子部品搭載用の第1主面側凹部と、各製品部の外周境界線の内側に第1主面側凹部を包囲して設けられた未焼成封止用メタライズ層と、第2主面側の各製品部の外周境界線上に第2主面側に開口して設けられ、内壁面に未焼成凹部メタライズ層を有する第2主面側凹部と、を備えた未焼成セラミック大判に対し、第1主面側から各製品部の外周境界線に沿って第1溝形成刃を差し入れ、第2主面側凹部と連通する第1ブレイク溝を形成する工程と、

上記未焼成セラミック大判を焼成し、第1ブレイク溝に沿って形成された封止用メタライズ層と、第2主面側凹部内に形成された凹部メタライズ層と、を有する連結セラミック配線基板とする焼成工程と、

上記封止用メタライズ層上および凹部メタライズ層上にメッキを施すメッキ工程と、を備え、上記未焼成封止用メタライズ層をなすメタライズペーストをその焼成収縮率が、上記未焼成セラミック大判をなすセラミックグリーンシートの焼成収縮率より大きいものとしたことを特徴とする連結セラミック配線基板の製造方法。

【請求項2】 第1主面及び第2主面を有し、分割後に多数の配線基板となる製品部と、第1主面側に開口する電子部品搭載用の第1主面側凹部と、各製品部の外周境界線の内側に第1主面側凹部を包囲して設けられた未焼成封止用メタライズ層と、第2主面側の各製品部の外周境界線上に第2主面側に開口して設けられ、内壁面に未焼成凹部メタライズ層を有する第2主面側凹部と、を備えた未焼成セラミック大判に対し、第1主面側から各製品部の外周境界線に沿って第1溝形成刃を差し入れ、第2主面側凹部と連通する第1ブレイク溝を形成する工程と、

上記未焼成セラミック大判を焼成し、第1ブレイク溝に沿って形成された封止用メタライズ層と、第2主面側凹部内に形成された凹部メタライズ層と、を有する連結セラミック配線基板とする焼成工程と、

上記メタライズ層に封止リングを接着する接着工程と、上記封止用メタライズ層上および凹部メタライズ層上にメッキを施すメッキ工程と、を備え、

上記未焼成封止用メタライズ層をなすメタライズペーストをその焼成収縮率が、上記未焼成セラミック大判をなすセラミックグリーンシートの焼成収縮率より大きいものとしたことを特徴とする連結セラミック配線基板の製造方法。

【請求項3】 前記セラミックグリーンシートの焼成収縮率を1としたとき、前記メタライズペーストの焼成収縮率が1.01～1.3の範囲にあることを特徴とする請求項1または2に記載の連結セラミック配線基板の製

造方法。

【請求項4】 前記第1ブレイク溝の前記第1主面上での幅は、前記第2主面側凹部の径よりも小さいことを特徴とする請求項1乃至3のいずれかに記載の連結セラミック配線基板の製造方法。

【請求項5】 前記第1溝形成刃は、所定の厚さを有する板状部と、所定の刃先角を有する先端部と、上記板状部と先端部との間に位置し、上記先端部の刃先角より小さなテーパ角を有する中間部と、を有し、

前記第1ブレイク溝は、上記第1溝形成刃を上記中間部まで差し入れて形成することを特徴とする請求項1乃至4のいずれかに記載の連結セラミック配線基板の製造方法。

【請求項6】 請求項1～5に記載の連結セラミック配線基板の製造方法によって製造した連結セラミック配線基板を、前記第1ブレイク溝に沿って各製品部ごとに分割することにより、各配線基板に個分けする配線基板の製造方法。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、連結セラミック配線基板の製造方法および配線基板の製造方法に関し、詳しくは、分割後にSAWフィルタ、水晶振動子、トランジスタ、発光素子、IC等の電子部品を封止するパッケージとして用いられるセラミック製の配線基板（リードレスチップキャリア）となる連結セラミック配線基板の製造方法、およびその連結セラミック配線基板を分割して得られる配線基板の製造方法に関する。

【0002】

【従来の技術】従来、SAWフィルターや発光素子等の小型電子部品を收容するための電子部品収納用の配線基板61は、図6に示すようにアルミナセラミック等の電気絶縁材料からなり、第1主面（上面）64中央に電子部品を搭載するための第1主面側凹部（キャビティ）62、タングステン、モリブデン等の高融点金属粉末からなる配線用メタライズ層、第1主面上に第1主面側凹部62を包囲して設けられ、上面に金属製蓋体が接合される平面四角枠状の封止用メタライズ層65とを有し、第1主面側凹部62内には電子部品の各電極を上記配線用メタライズ層に電気的に接続しつつ電子部品を搭載し、しかる後、封止用メタライズ層65に金属製蓋体をハンタ等の封止材を介して接合させ、電子部品を気密封止することによって最終製品となる。

【0003】このように用いられるセラミック製の配線基板61は、配線層用や封止用のメタライズ層65をなすメタライズペースト（インク）の印刷されたアルミナなどからなるセラミックグリーンシートを積層、圧着し、これを焼成して製造されるのが普通である。このような配線基板61は、通常、生産性を上げるため、数十ないし数百の配線基板部分（製品部）が縦横に繋がった

形のセラミックグリーンシートを積層、圧着し、その状態において焼成し、多数の基板が縦横に連なった連結セラミック配線基板81とし、最終工程でこれを個々の基板単位に分割する（折り取る）ことで大量生産している（図7参照）。

【0004】そして、焼成後におけるこのような分割を可能とするため、積層されたセラミックグリーンシート積層体（本明細書において未焼成セラミック大判という）の段階で、隣接する基板部分相互の境界に第1ブレイク溝78（以下単に溝ともいう）を入れておくのが普通である（図7参照）。すなわち、溝入りの未焼成セラミック大判を焼成して、封止用メタライズ層65および配線用メタライズ層の露出表面にニッケルおよび金からなるメッキ層を電解メッキにより順次層着し、第1ブレイク溝78の形成された連結セラミック配線基板81とし、第1ブレイク溝78に沿ってブレイク（分断）して基板単位に個分けするのである。

【0005】ところで、セラミック製配線基板61は、その側面に半径約0.2mm程度の断面略半円状の切欠部67が複数形成されており、この切欠部67の内壁面に設けられた切欠メタライズ層69を介して配線用メタライズ層が外側面および第2主面66側に導出されている。したがって、連結セラミック配線基板81には、分割後に配線基板を実装基板と電気的に接続するための切欠部67となる断面略円状の第2主面側凹部77が形成されている。この第2主面側凹部77はその内周面および底面に凹部メタライズ層79が形成されており、分割すると断面略半円状の切欠部67および切欠メタライズ層69が配線基板の外側面に形成される（特開2000-68414号公報参照）。

【0006】しかしながら、凹部メタライズ層79の外表面に電解メッキ方法によりニッケルメッキ層および金メッキ層を層着させる場合、第2主面側凹部77の内表面にある凹部メタライズ層79は一方が塞がれていて凹部内でのメッキ液の循環が極めて悪いことから、メッキを完全に層着させることができず、凹部メタライズ層79の表面が露出した状態となってしまう。そのためこの露出部に大気中に含まれる水分が付着すると該水分がニッケルメッキ層および金メッキ層に接触して電解質として働き、ニッケルメッキ層と金メッキ層との間に両金属のエネルギー準位の相違から電流が流れる電気作用を生じてエネルギー準位が低いニッケルメッキ層を徐々に溶出させ、隣接する凹部メタライズ層79間を短絡させてしまうという欠点が知られている（特開平6-33297号公報参照）。

【0007】こうした問題点を解決するために、図8に示すように、第1主面側の第1ブレイク溝88と第2主面側凹部77とを連通させ、第2主面側凹部77内に第1ブレイク溝88を介してメッキ液を流通させる方法が知られている（特開平9-74151号公報参照）。

【0008】

【発明が解決しようとする課題】ところが、第1ブレイク溝と第2主面側凹部とを連通させるためには、図8の連結セラミック配線基板91に示すように、その分だけ第1ブレイク溝を深く形成する必要がある。第1ブレイク溝を形成するための溝形成刃を深くいれると、溝形成刃の刃先角が大きければ、図8に示すように、第1ブレイク溝88の第1主面74上での開口幅が大きくなってしまい、封止用メタライズ層65が十分な幅をもって形成できないか、配線基板が大型化してしまうという問題が生じる。

【0009】また、溝形成刃の刃先角が小さければ、図9に示す連結セラミック配線基板のように、第1ブレイク溝98の第1主面64上での開口幅は小さく抑制できるが、焼成前のスプリングバックや焼成時の溶着等（特開2000-141344号参照）により第1ブレイク溝98、特に第1ブレイク溝98と第2主面側凹部77との連通部が塞がってしまい、第2主面側凹部77内でのメッキ不良、ブレイク性悪化等の不具合を引き起こすことがあった。このようなブレイク性の悪化は、セラミック基板の焼成過程での収縮が20%程度と大きいため、焼成前に入れられた第1ブレイク溝98の幅が狭くなることなどにも起因するものと考えられる。

【0010】従来、こうした問題を解消すべく、そのブレイク溝の幅を大きくしたり、溝（溝底）の角度を大きくしたりして対処していた。ところが、一辺が数mmしかない小さな配線基板の製造では、このような対策には自ずと限界がある。しかも小さな配線基板用の大判ほど、一定間隔における溝数が多くなる。一方、プレスによって入れられたブレイク溝は、溝形成刃を抜いた後でセラミックグリーンシートの弾性によって幾分復元する（閉じる）ように作用することから、配線基板が小さくなるほど溝幅は狭くなりがちであり、ブレイク溝の融着が発生しやすい。

【0011】また従来の基板の製造においては、このような問題に加えて次のような問題もあった。セラミック製配線基板のうち、第1主面の周囲にコパル等からなる封止用リング（金属枠）がロウ付けなどにより接着される配線基板は次のようにして製造される。すなわち、焼成後、大判の段階で基板単位の部分の表面の周囲つまりブレイク溝に沿って形成された封止用メタライズ層にメッキをかけ、その後において各基板部分の封止用メタライズ層にロウ材（球状又は棒状等の銀ロウなど）をセットしてシールリングを配置し、これを一括してロウ付けしていた。このリングの配置、ロウ付けにおいては、隣接する基板部分相互の境界はブレイク溝がなすが、リング同士の間隔（空隙）は、ブレイク溝分の微小な間隙しか確保されない。

【0012】このように、リング同士の間隔は、ブレイク溝分の微小な間隙であり、しかもその溝幅が狭いこと



から、ロウ付け時に溶融したロウがブレイク溝に流れ込んで融着したり、同溝でブリッジを形成したり、溝を埋めたりすることがあった。このような状態となると、第1ブレイク溝と第2主面側凹部との連通が確保されなくなり、第2主面側凹部内の凹部メタライズ層へのメッキ層着不良が生じることになる。また、前記したブレイク溝の融着による問題と同様、ブレイクに支障がでるため、分割後の製品に欠けなどの不良が発生しがちとなる。そして、こうした問題も小さな配線基板ほど発生しやすい。なお、このような問題の対策としては、リングをブレイク溝からなるべく距離をおいて配置することが考えられる。つまりリング接着面をなす封止用メタライズ層をブレイク溝（基板の外縁）からなるべく離すことで溶融ロウの流れ込みを防ぐというものであるが、一辺が数mmといった小型の基板では、そのような寸法上の余裕はない。したがって、従来こうした小型の基板の製造歩留まりはきわめて低いものであった。本発明は、こうしたセラミック製配線基板の製造上における問題点を解消することをその目的とする。

【0013】

【課題を解決するための手段】上記の目的を達成するため、請求項1に記載の発明は、第1主面及び第2主面を有し、分割後に多数の配線基板となる製品部と、第1主面側に開口する電子部品搭載用の第1主面側凹部と、各製品部の外周境界線の内側に第1主面側凹部を包囲して設けられた未焼成封止用メタライズ層と、第2主面側の各製品部の外周境界線上に第2主面側に開口して設けられ、内壁面に未焼成凹部メタライズ層を有する第2主面側凹部と、を備えた未焼成セラミック大判に対し、第1主面側から各製品部の外周境界線に沿って第1溝形成刃を差し入れ、第2主面側凹部と連通する第1ブレイク溝を形成する工程と、上記未焼成セラミック大判を焼成し、第1ブレイク溝に沿って形成された封止用メタライズ層と、第2主面側凹部内に形成された凹部メタライズ層と、を有する連結セラミック配線基板とする焼成工程と、上記封止用メタライズ層上および凹部メタライズ層上にメッキを施すメッキ工程と、を備え、上記未焼成封止用メタライズ層をなすメタライズペーストをその焼成収縮率が、上記未焼成セラミック大判をなすセラミックグリーンシートの焼成収縮率より大きいものとしたことを特徴とする。

【0014】本明細書において、メタライズペーストの焼成収縮率とは、メタライズペーストが焼成されるまでの収縮率をいい、また、セラミックグリーンシートの焼成収縮率とは、セラミックグリーンシートが焼成されるまでの収縮率をいうものとする。

【0015】このような連結セラミック配線基板の製造方法においては、第1主面側から第1ブレイク溝が入れた多数個取りの未焼成セラミック大判（以下単に大判とも言う）を焼成し、メッキなどの各工程を経て同溝

に沿って分断（いわゆる、チョコレートブレイク）する際には次のようである。このような配線基板の製造においては、大判の焼成工程で各製品部（基板部分）の周囲における未焼成封止用メタライズ層の焼成収縮がセラミックのそれより大きいため、第1ブレイク溝の開口において同溝幅の拡張作用が発揮される。すなわち、焼成過程において封止用ブレイク溝が融着するのを防止する働きをするため、第1ブレイク溝と第2主面側凹部との連通が阻害されたり、ブレイク性が低下したりするのが防止される。

【0016】従来のこの種の基板の製造においては、セラミックとメタライズ層の焼成収縮率の差による基板の反り等の変形や内部配線の切断等の不具合の発生を防止するため、配線層や封止面をなすメタライズ層用のメタライズペーストは、その焼成収縮率がセラミックグリーンシートの焼成収縮率と努めて同じとなるように調製されたものが使用されていた。したがって、焼成されることで焼成済み大判はその全体について均一に収縮する。一方、焼成前に入れられるブレイク溝の幅は0.05～0.08mm程度と微小であり、これも焼成収縮率により同様に狭くなることから第1ブレイク溝は融着を起こし易いと考えられる。

【0017】これに対して本発明では、基板における一方の主面（第1主面）の周囲の封止用メタライズ層をその焼成収縮率が、セラミック製配線基板をなすセラミックの焼成収縮率より大きいものとしたため、前記の製法ではその封止用メタライズ層はセラミックよりも大きく縮む。つまり前記の製法では、大判を平面的に見ると第1ブレイク溝の両側の製品部（基板部分）の周囲にある封止用メタライズ層は、焼成過程でそれぞれ未焼成封止用メタライズ層の面に沿って表面のセラミックを圧縮するため、第1ブレイク溝の幅をその開口側を開かせるように作用する。したがって、焼成後は、従来のようにセラミックと同じ焼成収縮率の未焼成封止用メタライズ層を使用した場合に比べると溝の幅が広がるため、融着が防止される。かくして、その後、第2主面側凹部内の凹部メタライズ層へのメッキ層着性が改善され、第1ブレイク溝に沿って個分けする際の不具合の発生が防止される結果、製造歩留まりの向上が図られる。

【0018】そして請求項2に記載の発明は、第1主面及び第2主面を有し、分割後に多数の配線基板となる製品部と、第1主面側に開口する電子部品搭載用の第1主面側凹部と、各製品部の外周境界線の内側に第1主面側凹部を包囲して設けられた未焼成封止用メタライズ層と、第2主面側の各製品部の外周境界線上に第2主面側に開口して設けられ、内壁面に未焼成凹部メタライズ層を有する第2主面側凹部と、を備えた未焼成セラミック大判に対し、第1主面側から各製品部の外周境界線に沿って第1溝形成刃を差し入れ、第2主面側凹部と連通する第1ブレイク溝を形成する工程と、上記未焼成セラミ

ック大判を焼成し、第1ブレイク溝に沿って形成された封止用メタライズ層と、第2主面側凹部内に形成された凹部メタライズ層と、を有する連結セラミック配線基板とする焼成工程と、上記メタライズ層に封止リングを接着する接着工程と、上記封止用メタライズ層上および凹部メタライズ層上にメッキを施すメッキ工程と、を備え、上記未焼成封止用メタライズ層をなすメタライズペーストをその焼成収縮率が、上記未焼成セラミック大判をなすセラミックグリーンシートの焼成収縮率より大きいものとしたことを特徴とする。

【0019】このような連結セラミック配線基板は、連結セラミック配線基板における各製品部（基板部分）の周囲の封止用メタライズ層、その他メタライズ層にメッキをかけ、その後においてロウ材がセットされ、その後、リングが配置されてロウ付けされ、さらに、所定のメッキをかけた後で個々の基板ごとにブレイクされる。したがって、このような基板についても前記製法において、大判の第1ブレイク溝はその開口側が拡張作用を受ける。つまり、隣接する製品部相互の封止リング同士の間隔をなす第1ブレイク溝は、従来技術による場合よりも広がるため、その分、封止リングのロウ付け時においても溶融したロウが第1ブレイク溝に流れて融着したり、第1ブレイク溝と第2主面側凹部との連通部分を塞いだり、ブリッジを形成したりするなどの不具合が生じにくい。

【0020】上記のいずれの方法においても、焼成過程で溝幅の拡張作用があるため、第1ブレイク溝が融着し難いし、封止用リングをロウ付けする場合には接着剤（ロウ）がブリッジを形成し難い。したがって、いずれの方法においても、製品部単位とするブレイク時における不具合が回避される。また、第2主面側凹部内へ第1ブレイク溝を介してメッキ液が流通・循環するため、第2主面側凹部内のメタライズ層への電解メッキ層形成も良好に行える。なお、いずれの方法においても、前記セラミックグリーンシートの焼成収縮率を1としたとき、前記メタライズペーストの焼成収縮率が1.01~1.3の範囲にあるようにするのが好ましい。

【0021】また、前記第1ブレイク溝の前記第1主面上での幅は、前記第2主面側凹部の径よりも小さくすることが好ましい。配線基板の小型化の要請に応えつつ、封止用メタライズ層の幅を最大限確保するには、第1主面上での第1ブレイク溝の開口幅はできるだけ小さくするのが好ましく、具体的には第2主面側凹部の径よりも小さくすることが好ましい。本来、第2主面側凹部を第1主面側まで貫通させずに有底孔とした理由は、第1主面上で封止用メタライズ層を設けるのに十分なスペースを確保するためであるから、特開平9-74151号公報第5図に示すように、第1主面上での第1ブレイク溝の開口幅を第2主面側凹部の径と同等以上にすると、第2主面側凹部を有底孔とした本来の効果が得られなくな

ってしまう。

【0022】さらに、前記第1溝形成刃は、所定の厚さを有する板状部と、所定の刃先角を有する先端部と、上記板状部と先端部との間に位置し、上記先端部の刃先角より小さなテーパ角を有する中間部と、を有するものとする。先端部の刃先角は、第1ブレイク溝の融着を防止するためには、比較的大きい（鈍角）とするのが好ましく、中間部のテーパ角は第1主面上での第1ブレイク溝の開口幅を最小限とするためには、比較的小さくするのが好ましい。

【0023】なお、第1ブレイク刃の先端部の刃先角は、スプリングバックおよび溶着を防止するためには、 $30^\circ$ 以上が好ましく、 $35^\circ$ 以上がより好ましい。また、中間部の角度は、 $30^\circ$ 以下が好ましく、 $25^\circ$ 以下がより好ましい。

【0024】加えて、前記第1ブレイク溝は、前記第1溝形成刃を上記中間部まで差し入れて形成するのが好ましい。第1溝形成刃を板状部（ストレート部）まで差し入れると、第1溝形成刃を引き抜くときに、第1ブレイク溝の側壁を擦り上げてしまい、第1主面上の第1ブレイク溝開口近傍にバリを生じるなどの不具合が発生してしまうからである。なお、ブレイク溝の側壁の擦り上げを防止するためには、中間部の角度は $5^\circ$ 以上、さらには $10^\circ$ 以上がより好ましい。

【0025】さらに、本発明は、上記した連結セラミック配線基板の製造方法によって製造した連結セラミック配線基板を、前記第1ブレイク溝に沿って各製品部ごとに分割することにより、各配線基板に個分けする配線基板の製造方法を含む。上記製造方法で得られた連結セラミック配線基板は、第1ブレイク溝での融着が防止されているので、精度良く分割される。しかも、第2主面側凹部内の凹部メタライズ層にも均一にメッキ層が形成されているので、第2主面側凹部を分割して得られた断面略円状の切欠部に耐蝕性に優れた側面電極を形成することができる。

【0026】

【発明の実施の形態】以下、本発明の実施の形態を図を参照しつつ説明する。本実施例で製造されるセラミック製の配線基板1を図1に示す。このセラミック製の配線基板1は、 $3.8 \times 3.8 \times 1.1$  mmの略長形状をなし、第1主面（上面）4および第2主面（下面）6を有している。配線基板1は、3層の積層構造で矩形板状に形成され、中央には平面視方形で下方に向かって階段状で幅狭となるキャビティー（凹部）2を備えている。そして、配線基板1の第1主面4の周囲には、タングステン、モリブデンなどの高融点金属を主成分とする、封止用メタライズ層5が所定の幅で平面視四角枠状に形成されている。このメタライズ層5には図示はしないがニッケルメッキ層が形成され、さらに最表面には金メッキ層が形成されている。

【0027】また、配線基板の側面には、半円筒状の切欠部7（直径0.3mm、高さ0.8mm）が設けられている。その内壁面には切欠メタライズ層9と、さらにその表面に被着されたニッケルメッキ層および金メッキ層が形成され、側面電極を成しており、内部の配線用メタライズ層（図示しない）と導通している。これらの切欠部7は、第2主面6側に偏って形成されている。つまり、第1主面4の外周縁には第2主面6の外周縁と異なり、半円筒状の切欠部7による凹みが存在しない。このため、封止用メタライズ層5は、切欠部7の有無にかかわらず、第1主面4の外周縁近傍まで形成することができる。

【0028】このような配線基板1は、次記するようにして製造されるが、封止用メタライズ層5はその焼成収縮率が25%のものが使用されており、基板1をなすセラミック及びその他の図示しない内部配線などをなすメタライズ層は、焼成収縮率がともに20%のものが使用されている。なお、このような配線基板1は、後工程でキャピティ2に電子部品が搭載され、その後、図示しない蓋が被せられてメタライズ層5にハンダ付けされ、気密封止される。

【0029】さて次にこのような基板1の好適な製法について、図2ないし図5を参照して詳細に説明する。まず、基板1の各セラミック層をなし所定数の基板部分がとれるように形成されたアルミナ（ $Al_2O_3$ ）を主成分とするセラミックグリーンシート（厚さ0.25～0.3mm）をそれぞれ製造する。そして、各セラミック層11、12、13に対応する形状に切断、打ち抜きし、封止用メタライズ層や配線層さらには電解メッキ用の共通導体層などのメタライズペーストを印刷する。

【0030】メタライズペーストは、最上層をなすセラミックグリーンシートの表面に印刷される封止用メタライズ層5をなすもの以外は、セラミックグリーンシートの焼成収縮率（本形態では20%）と同じとなるように、例えばW（タングステン）：Mo（モリブデン）： $Al_2O_3$ （アルミナ）＝95：5：3の重量比となるように調製したものを使用した。一方、封止用メタライズ層5をなすように印刷されるメタライズペーストのみ、焼成収縮率が25%となるように、W：Mo： $Al_2O_3$ を90：10：1の重量比となるように調製したものを使用し、厚さ0.02～0.04mmで印刷した。なお、この封止用メタライズ層5をなすメタライズペーストに含有されるW及びMoは1.0～2.0μmの粒径のものを使用した。

【0031】こうして製造されたセラミックグリーンシートを積層、圧着して、図2に示す3層のセラミック層11、12、13からなる未焼成セラミック大判31を製造した。同図中、25は焼成後、封止用メタライズ層をなすように第1主面24上に印刷されたメタライズペースト（未焼成封止メタライズ層）である。このような

未焼成セラミック大判31においては、最外側の耳部（枠状部）のみが捨て代となるように、縦横に連続して製品部21が連なって配置されているのが普通である。また本形態では、耳部（枠状部）のうち最外側の製品部21との境界寄り部位にも、未焼成封止用メタライズ層25が同様に印刷・形成されている。また、第2主面26側には、未焼成セラミック大判を焼成し、分割した後で切欠部7となるように第2主面26側に開口して形成された第2主面側凹部27が、各製品部21の外周境界線上に形成されている。また、各第2主面側凹部27の内壁面には、焼成後に凹部メタライズ層19、分割後に切欠メタライズ層9となる未焼成凹部メタライズ層29が設けられている。

【0032】次にこのような未焼成セラミック大判31の例えば第1主面側の製品部21の境界に、縦横に格子状をなすように第1ブレイク溝28を第1溝形成刃40（図4参照）を所定深さ（例えば、第1主面側から全厚の40～50%）差し入れて形成する（図3参照）。なお、本実施形態では説明を省略するが、第2主面26側にも、第1ブレイク溝28に対応する位置に第2溝形成刃を所定深さ、例えば、第2主面側から全厚の10～20%差し入れることによって第2ブレイク溝を形成するとよい。ただし、第1ブレイク溝28は、製品部21相互の境界をなすものであり、第1主面24では封止用メタライズペースト（層）25をその幅方向の略中央において切断している。

【0033】また、第1ブレイク溝28を形成する際に第1溝形成刃40を第2主面側凹部27の底面を貫通する深さまで差し入れる。この工程によって、内壁面に未焼成凹部メタライズ層29を有する第2主面側凹部27は、第2主面26側に開口するだけでなく、第1主面24側にも通じた状態になる。具体的には、第2主面側凹部27の略円形状の底面の略中央に、第1ブレイク溝28によって、幅0.05mm～0.08mmの開口（連通部）が形成され、第2主面側凹部27と第1ブレイク溝28とが連通している。

【0034】具体的には、図4に示すような構造の第1溝形成刃40を用いて第1ブレイク溝28を形成する。すなわち、第1溝形成刃40は、略平行な板状部41と、刃先角40°の先端部42と、18°のテーパ角を有する中間部43と、からなる。このような第1溝形成刃40を第1主面24側から中間部43の途中まで未焼成セラミック大判31に差し入れて（図3参照）、引き抜くことにより、各配線基板領域21の外周境界線に沿って第1ブレイク溝28を形成する（図5参照）。なお、第1主面24上での第1ブレイク溝28の幅は約0.2mmであり、第2主面側凹部27の径よりも小さくされており、その分未焼成封止用メタライズ層25を幅広に形成できる。

【0035】先端部42は、30°以上（本実施形態で

は40°)の刃先角をなすので、焼成前のスプリングバックおよび焼成時の溶着を有効に防止できる。また、中間部43は刃先角より小さなテーパ角(5°以上30°以下、本実施形態では18°)となっているので、第1溝形成刃40を深くまで差し入れても第1主面24上での開口幅があまり広くならないので、封止用メタライズ層5をなす未焼成封止用メタライズ層25を十分な幅で形成することができる。さらに、5°以上(本実施形態では18°)のテーパ角を有する中間部43の途中まで第1溝形成刃40を差し入れるので、擦り上げずに抜き取ることができ、第1ブレード溝28の第1主面24側の開口近傍にバリが発生するのを防止できる。なお、本実施形態では、第1ブレード溝28(および第2ブレード溝)を未焼成封止用メタライズ層の印刷・形成後に入れたが、セラミックグリーンシートの成形後、焼成前であれば、未焼成封止用メタライズ層の印刷・形成前にいれてもよい。

【0036】次いでこの未焼成セラミック大判31を焼成し、連結セラミック配線基板(焼成済み大判)とする。このようにして得られた焼成済み大判の各基板部分の境界をなす第1ブレード溝28は、開口側が拡張するように変形している。すなわち、焼成後はセラミックの焼成収縮により大判全体としてみると、未焼成セラミック大判31より略20%小さく薄くなっている。

【0037】一方、この焼成過程では表面の未焼成封止用メタライズ層25のみ、収縮率が25%と大きいいため、その差の5%分、第1主面側のセラミック層11の最表面のうち封止用メタライズ層5の存在する各領域では、セラミック層11の最表面をその面に沿って収縮させるように作用する。未焼成封止用メタライズ層25の存在する各領域では、これに接するセラミック層11が未焼成封止用メタライズ層25の焼成収縮によって表面に沿って縮められる力を受けるため、同表面に沿って圧縮されるように変形する。その変形はセラミック層11の最表面で最大となる。

【0038】焼成過程におけるこうした作用により、未焼成封止用メタライズ層25が両側に存在する第1ブレード溝28には、その溝幅を広げる作用が働くため、その分、従来の溝の開口状態よりも広がるため、焼成して得られる連結セラミック配線基板51はその第1ブレード溝28が融着又は閉じることが積極的に防止されたものとなる。また、この焼成工程により、未焼成封止用メタライズ層25、未焼成凹部メタライズ層29は、封止用メタライズ層5、凹部メタライズ層59となる。なお、その他の部位については、簡略化のため、焼成前と焼成後について同一符号をもって記載するものとする。

【0039】こうして得られた連結セラミック配線基板(焼成基板)51は、その後、封止用メタライズ層5などに、電解メッキにより、ニッケル(Ni)メッキ及び金(Au)メッキをかけることで連結セラミック配線基

板(焼成済み大判)として完成する。このメッキ工程においても、第1ブレード溝28に融着がなく第2主面側凹部27との連通が十分に確保されているため、第2主面側凹部27内においてもメッキ液が十分に流通・循環し、第2主面側凹部27内壁面のメタライズ層上にニッケルメッキ層、金メッキ層を均一かつ十分な厚さで形成することができる。

【0040】次にメッキがかけられた連結セラミック配線基板51をブレード溝に沿ってブレードする(折り取る)ことで短冊状とし、さらに、基板1ごととなるようにブレードすることで、図1に示したセラミック製の配線基板1が一度に多数得られる。このブレードにおいては連結セラミック配線基板51のブレード溝は、その作業が円滑に行われる。また本形態では耳部(棒状部)のうち、最外側の製品部21との境界寄り部位にも未焼成封止用メタライズ層25と同様にメタライズペーストが印刷されていたので、最外側の第1ブレード溝28においても融着が効果的に阻止される。すなわち、本形態の配線基板及びその製法によれば、ブレードにおけるカケ等の不具合の発生が防止されるため、製造歩留まりを高めることができる。

【0041】なお本発明において、封止用のメタライズ層(ペースト)の組成は、基板をなすセラミックの焼成収縮率を考慮し、溝幅の適切な拡張作用が得られる範囲で、焼成収縮率がセラミックの焼成収縮率より大きくなるように適宜に設定すれば良い。焼成収縮率を大きくするには、モリブデンの含有率を上げることと、含有するモリブデン及びタングステンの粒径を小さくすることが有効である。タングステンよりもモリブデンの方が焼結性がよい(収縮が大きい)こと、粒径の小さい方が焼結性がよいためである。

【0042】なお、前記実施形態により製造された連結配線基板には、以下の工程により、表面には金メッキ層は設けず、ニッケルメッキ層のみ形成した状態で封止用メタライズ層5上に封止リングをロウ付けしてもよい。各製品部21の封止用メタライズ層5に対応した平面視四角棒状のロウ材(銀ろう)のブリフォームを各封止用メタライズ層5上に載置し、加熱・溶融させて、ロウ材を封止用メタライズ層5上に形成する。その後、予めロウ材を被着させた封止用メタライズ層5の上に平面視四角棒状のコパールからなる封止リングを載置し、このような状態で、再度、ロウ材を加熱溶融させ、封止リングのろう付けを完了する。

【0043】封止リングのロウ付けを終えた大判1は、シールリングの表面および各配線層の表面にNiメッキやAuメッキ等のメッキを施した後、各第1ブレード溝14に沿って分割され、多数の配線基板(チップキャリア)となる。配線基板は、キャピティ2にSAWフィルタ等の電子部品が搭載された後、シールリングに蓋を接合する等して用いられる。

【0044】また、上記実施形態においては、中間部が一つのみの溝形成刃を例示したが、テーパ角の異なる複数の中間部を有する溝形成刃を用いることもできる。たとえば、先端部が $40^\circ$ 、第1中間部が $25^\circ$ 、第2中間部が $18^\circ$ というように複数の中間部を有する溝形成刃も用いることができる。

【0045】さらに、上記したように中間部を有する溝形成刃を用いるのがより好ましいが、必ずしもこれに限定されず、従来と同じく中間部のない溝形成刃を用いることもできる。その場合には、第1主面上での開口幅が大きくなりすぎないように、刃先角を $10^\circ \sim 35^\circ$ 程度にするとよい。この場合でも、基板における一方の主面（第1主面）の周囲の封止用メタライズ層をその焼成収縮率が、セラミック製配線基板をなすセラミックの焼成収縮率より大きいものとしたため、その封止用メタライズ層はセラミックよりも大きく縮み、第1ブレイク溝が塞がるのを防止できる。

【0046】また、本発明のセラミック製配線基板は、その形状ないし構造に関係なく具体化できるなど、本発明の要旨を逸脱しない限りにおいて適宜設計変更して具体化できる。また、本発明のセラミック製配線基板には、低温焼成のガラスセラミック製のもの、窒化アルミニウムや窒化珪素などのアルミナ以外のセラミック製のものも含むことができる。

【0047】

【発明の効果】以上の説明から明らかなように本発明によれば、配線基板の製造における未焼成セラミック大判の焼成過程で、第1ブレイク溝の溝幅を拡張させることができる。したがって、従来のように第1ブレイク溝の融着などに起因する連結セラミック配線基板のメッキ不良やブレイク不良を防止できるため、この種の製法における製造歩留まりの向上が図られる。本発明によれば、水晶振動子などに用いられるリードレスチップキャリアのように小型のセラミック製配線基板の製造において、その効果に著しいものがある。

【図面の簡単な説明】

【図1】本発明に係るセラミック製配線基板の実施形態例を封止面側から見た斜視図。

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\*【図2】本発明で用いる未焼成セラミック大判の断面図。

【図3】図2に示す未焼成セラミック大判にブレイク溝を形成する工程を示す説明図。

【図4】図3のブレイク溝形成工程で用いる溝形成刃の先端近傍の断面図。

【図5】本発明に係る連結セラミック配線基板の部分拡大断面図。

【図6】従来のセラミック製配線基板の断面図。

【図7】従来の連結セラミック配線基板の部分拡大断面図。

【図8】従来の他の連結セラミック配線基板の部分拡大断面図。

【図9】従来の他の連結セラミック配線基板の部分拡大断面図。

【符号の説明】

- |          |                         |
|----------|-------------------------|
| 1        | セラミック製配線基板              |
| 2        | 第1主面側凹部（キャビティ）          |
| 4        | 第1主面                    |
| 5        | 封止用メタライズ層               |
| 6        | 第2主面                    |
| 7        | 切欠部                     |
| 9        | 切欠メタライズ層                |
| 11、12、13 | セラミック層                  |
| 21       | 製品部                     |
| 25       | 未焼成封止用メタライズ層（メタライズベースト） |
| 27       | 第2主面側凹部                 |
| 28       | 第1ブレイク溝                 |
| 29       | 未焼成凹部メタライズ層             |
| 31       | 未焼成セラミック大判              |
| 40       | 第1溝形成刃                  |
| 41       | 板状部                     |
| 42       | 先端部                     |
| 43       | 中間部                     |
| 51       | 連結セラミック配線基板             |
| 59       | 凹部メタライズ層                |

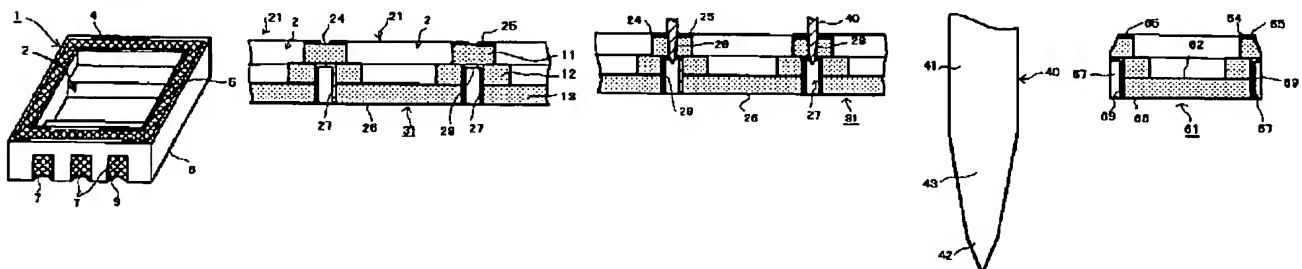
【図1】

【図2】

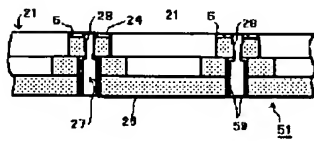
【図3】

【図4】

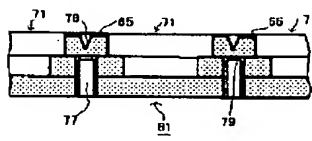
【図6】



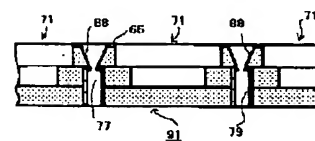
【図5】



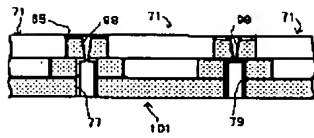
【図7】



【図8】



【図9】




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フロントページの続き

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